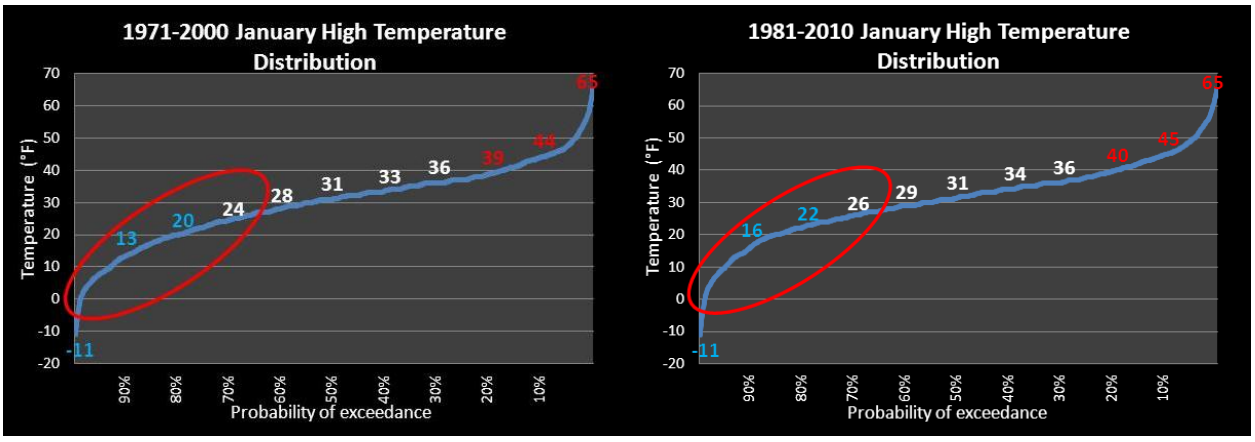
The National Weather Service uses a period of 30 years of temperatures and precipitation data to calculate an average or "normal" of several meteorological variables such as: temperatures, rainfall and snowfall. Every decade this 30 year normal is recalculated to drop the oldest decade and add the latest decade into the calculation. For the past 10 years the normal period utilized the 1971 to 2000 time period. However, now that we are through the first decade of the 21st century, the 30 year normal will now utilize the 1981 to 2010 period.

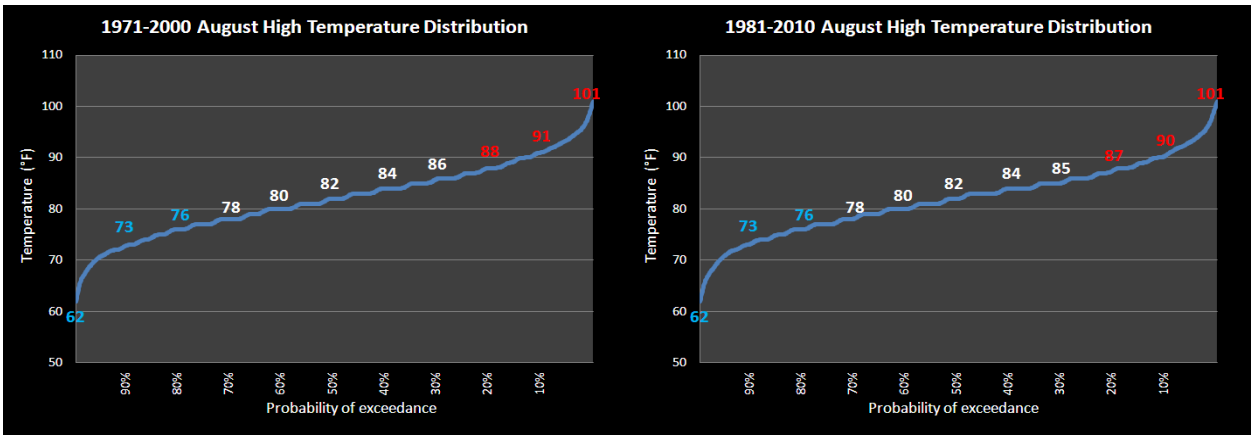
This time period change has, overall, led to warmer normal temperatures for much of the United States. This is the most pronounced during the winter season, and is largely due to the fact that the 1970s were a relatively cold decade in comparison to the 80s and 90s, along with the fact that the average temperatures during the winter have increased during the last decade.

Chicago

Temperatures:

To further illustrate the main changes in temperatures from the old 1971-2000 climate normal period to the latest 1981-2010 climate normal period, figures displaying the probabilities of exceedance for both high and low temperatures were constructed. For simplicity, the temperatures representing the 10th through the 90th percentiles have been added to the figures. Also displayed, are the highest and lowest temperatures recorded during the period. To interpret these graphics simply take, for example, the 80% percentile for high temperatures in January at O'Hare. During the 1971-2000 period, this corresponds to a temperature of 20 degrees. This means that on any given day during the month of January there was an 80% chance of experiencing a high temperature at or warmer than 20 degrees. Now comparing this to the 1981 to 2010 period, the 80 percentile has warmed to 22 degrees. This simply means that there is now a slightly higher than 80% chance of exceeding 20 degrees for a day time high temperature in January. The same technique can be used to interpret the remaining percentiles.





It is apparent from the graphics that the most significant changes occurred with the higher probabilities (e.g. the colder temperatures) during January. There was about a 2 to 3 degree increase in the 70th through the 90th percentiles (circled areas in the figures). This means there were fewer very cold days during the 1981-2010 period relative to the 1971-2000 period. Table 1. below shows that the number of days in January with high temperatures colder than 20 degrees dropped by 47. In contrast, the number of times in which the high temperatures exceeded 35 degrees only increased by 11. This means that although the number of very cold temperatures decreased, there was not a correspondingly high increase in the number of very warm days. Instead, there was more of an increase of the near normal days (e.g. highs between 20 and 39).

This same behavior was not observed during the summer season. The month of August is shown here, but other months during the warm season were similar. During August, there actually was not much of a change noted in the high temperature distributions shown above. However, table 1b. below shows that there was actually a slight decline in the number of very warm and cool days with a corresponding increase in the number of near normal days (shown in green) in the latest 30 year period.

Table 1a.

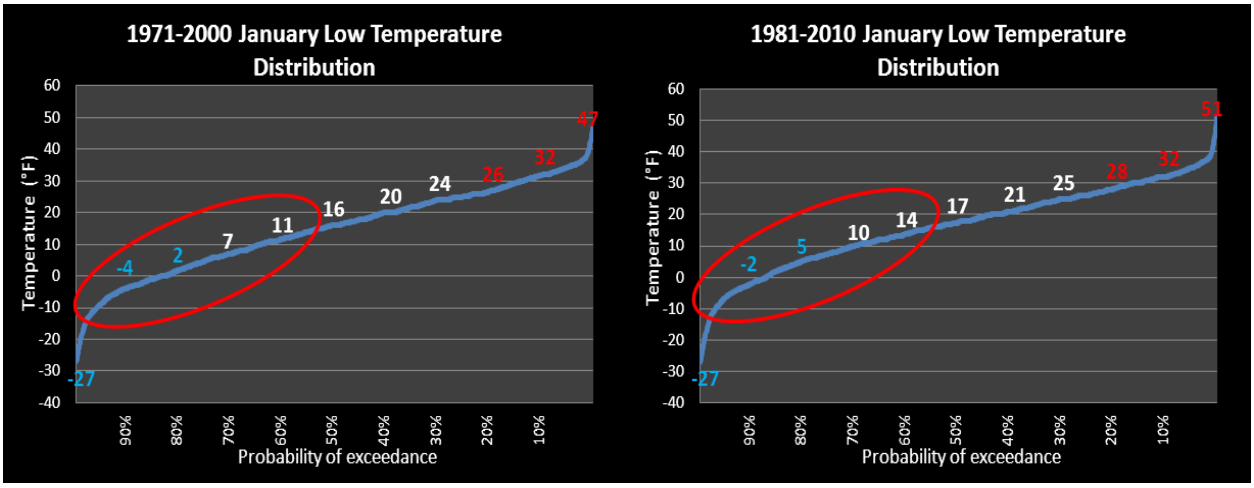
January	**Number of occurrences**							
High Temps	***70s***	***80s***	***90s***	***00s***		***81-10***	***71-00***	Difference
Above 40	43	60	50	61		150	197	+18
20-39	172	190	218	201		609	580	+29
Below 20	95	60	42	48		171	153	-47

Table 1b.

August	Number of occurrences							
High Temps	***70s***	***80s***	***90s***	***00s***		***81-10***	***71-00***	Difference
Above 89	44	38	25	29		92	107	-15
75-89	211	222	223	234		679	656	+23
Below 75	55	50	62	47		159	167	-8

The behavior of daily low temperatures was similar to that observed with the daily high temperatures. However, the differences are a bit more robust during the cold season. The figures below indicate that there was upwards of a 3 degree difference from the 60th through the 90th percentiles between the two 30 year periods. Based off this, it is not too surprising that the number of very cold low temperatures also decreased significantly (Table 2). However, unlike for high temperatures, the increase in the number of very warm temperatures nearly mimicked the decrease in the number of very cold days. This difference appears to be because the sharp decrease (increase) in the number of very cold (warm) temperatures during the past decade (table 2).

During August little to no change was noted in low temperatures during the warm season. However, similar to the daily high temperatures, there was a decrease noted in the number of very warm low temperatures in the latest 30 year period (Table 2b.).



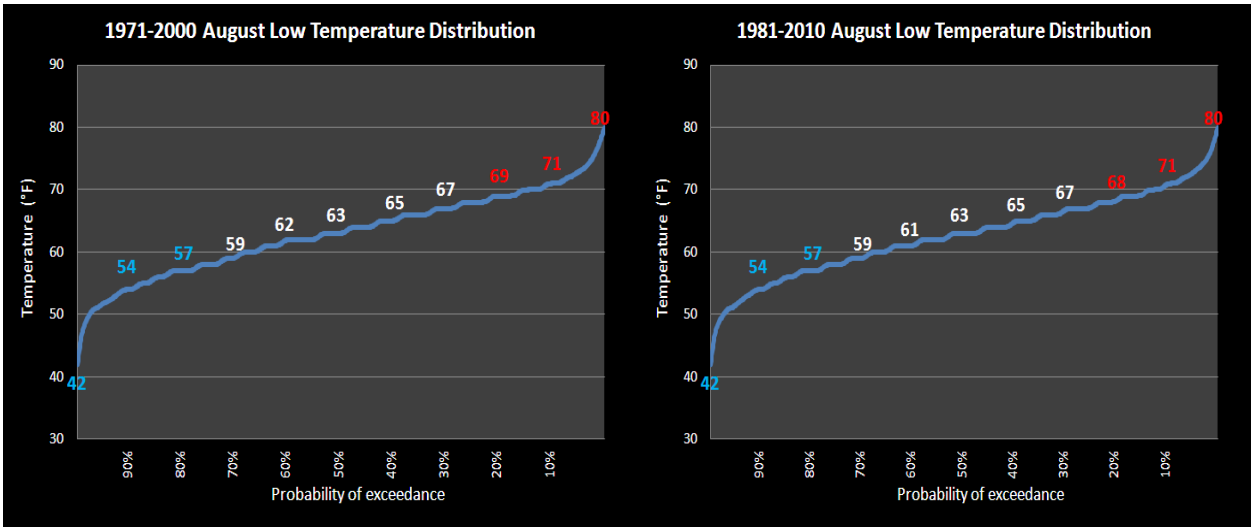


Table 2a.

January	Number of occurrences							
Low Temps	***70s***	***80s***	***90s***	***00s***		***81-10***	***71-00***	Difference
Below 1	65	59	44	21		124	168	-44
1 to 25	182	177	180	191		550	541	+9
Above 26	63	74	85	98		257	222	+35

Table 2b.

August	Number of occurrences							
Low Temps	***70s***	***80s***	***90s***	***00s***		***81-10***	***71-00***	Difference
Below 60	62	115	108	65		288	285	+3
60 to 69	183	155	156	197		508	494	+14
Above 70	65	39	46	47		132	150	-18

Precipitation:

Average annual precipitation has increased from 36.27” to 36.89” for the new 30 year normal period. However, this is not evenly spread throughout the year. The figures below display, the probability of exceedance for precipitation during all four meteorological seasons. Also shown are tables displaying the frequency of occurrences for various precipitation amounts for each season throughout the year. Overall, the figures indicate that precipitation decreased during the

winter and spring seasons and increased during the summer and fall seasons. The tables below indicate that much of this decrease in precipitation was due to a sharp decrease in light (0.24" or less) events. In contrast, during the summer and fall seasons, the increase in precipitation was largely due to increases in heavier rain events during the past decade.

Table 3a.

Winter	**Number of occurrences**							
Precipitation	***70s***	***80s***	***90s***	***00s***		***81-10***	***71-00***	Difference
0.01"-0.24"	313	283	258	248		789	854	-65
0.25"-0.49"	52	34	48	56		138	134	+4
0.50"-0.99"	28	24	26	26		76	78	-1
1.00"-1.49"	8	6	7	7		21	20	-1
1.5"+	5	4	2	2		8	11	-3

Table 3b.

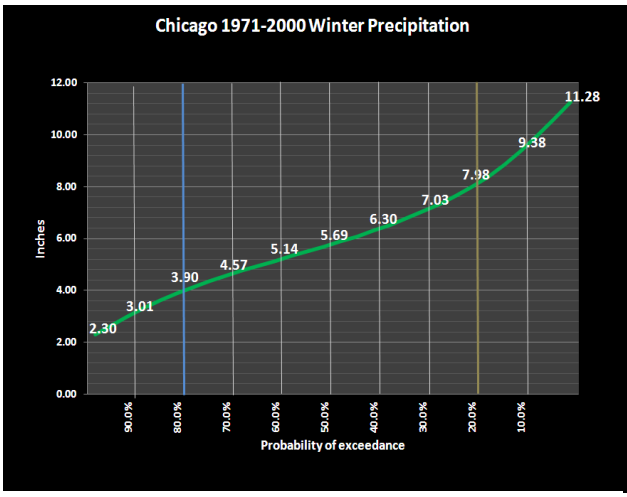
Spring	**Number of occurrences**							
Precipitation	***70s***	***80s***	***90s***	***00s***		***81-10***	***71-00***	Difference
0.01"-0.24"	297	275	267	272		814	839	-25
0.25"-0.49"	77	72	82	67		221	231	-10
0.50"-0.99"	53	40	39	50		129	132	-3
1.00"-1.49"	14	14	18	18		50	46	+4
1.5"-1.99"	5	6	2	2		10	13	-3
2.00"-2.49"	2	3	3	2		8	8	0
2.50"+	3	2	0	0		2	5	-3

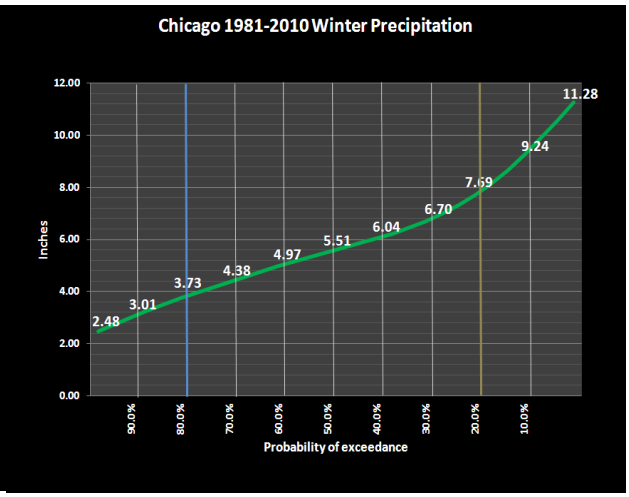
Table 3c.

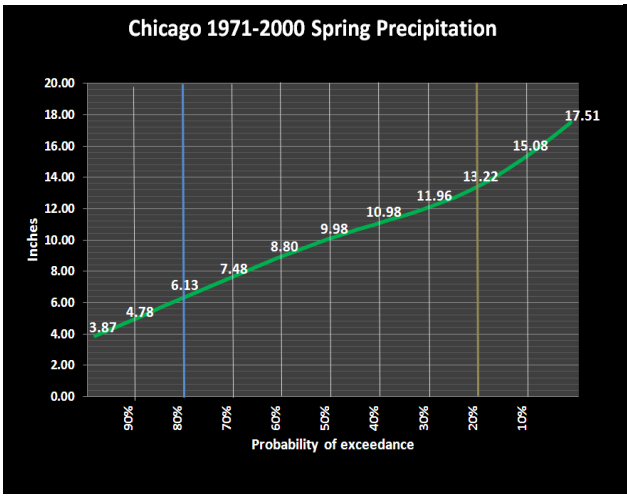
Summer	**Number of occurrences**							
Precipitation	***70s***	***80s***	***90s***	***00s***		***81-10***	***71-00***	Difference
0.01"-0.24"	236	231	207	219		657	674	-17
0.25"-0.49"	78	73	74	88		235	225	+10
0.50"-0.99"	56	55	51	47		153	162	-9
1.00"-1.49"	25	21	24	27		72	70	+2
1.5"-1.99"	9	15	11	7		33	35	-2
2.00"-2.49"	5	6	0	9		15	11	+4
2.50"-2.99"	2	4	2	3		9	8	+1
3.00"-3.49"	2	1	0	2		3	3	0
3.50"+	1	2	0	4		6	3	+3

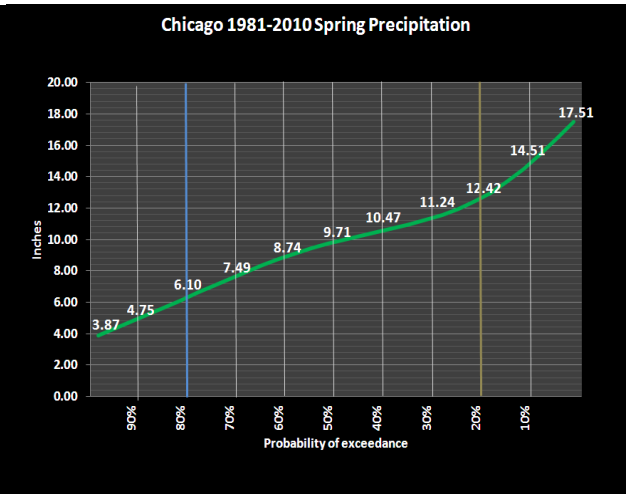
Table 3d.

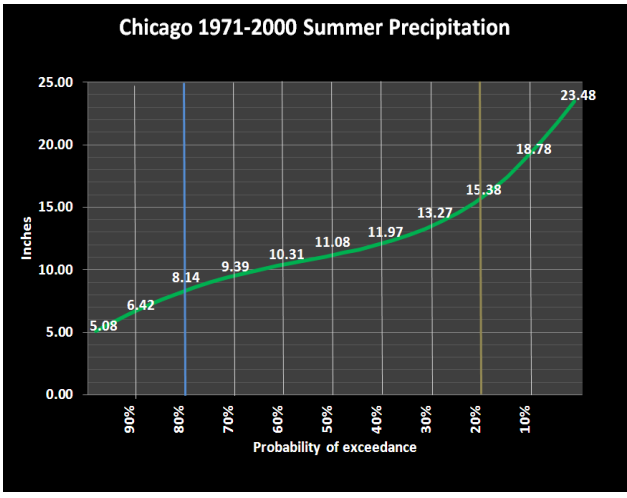
Fall	**Number of occurrences**							
Precipitation	***70s***	***80s***	***90s***	***00s***		***81-10***	***71-00***	Difference
0.01"-0.24"	255	239	236	232		707	730	-23
0.25"-0.49"	53	71	52	52		175	176	-1
0.50"-0.99"	36	55	37	48		140	128	+12
1.00"-1.49"	8	15	15	12		42	38	+4
1.5"-1.99"	5	11	6	8		25	22	+3
2.00"-2.49"	0	3	3	0		6	6	0
2.50"-2.99"	2	4	2	3		9	8	+1
3.00"-3.49"	0	0	0	0		0	0	0
3.50"+	1	1	0	3		4	2	+2

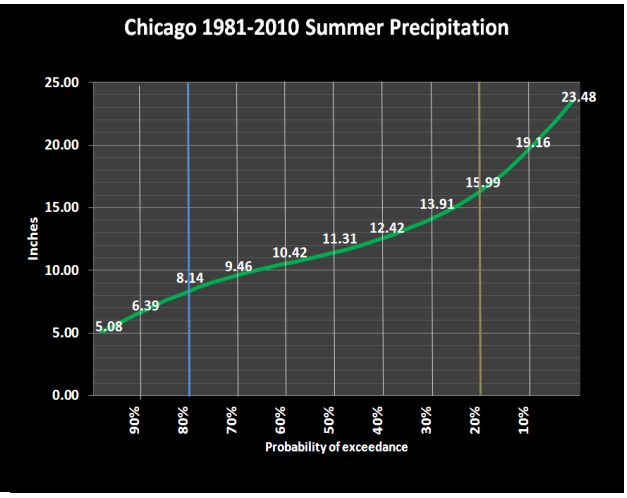

Chicago 1971-2000 Winter Precipitation
Inches
12.00
10.00
8.00
6.00
4.00
2.00
0.00
2.30
3.01
3.90
4.57
5.14
5.69
6.30
7.03
7.98
9.38
11.28
90.0%
80.0%
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
Probability of exceedance

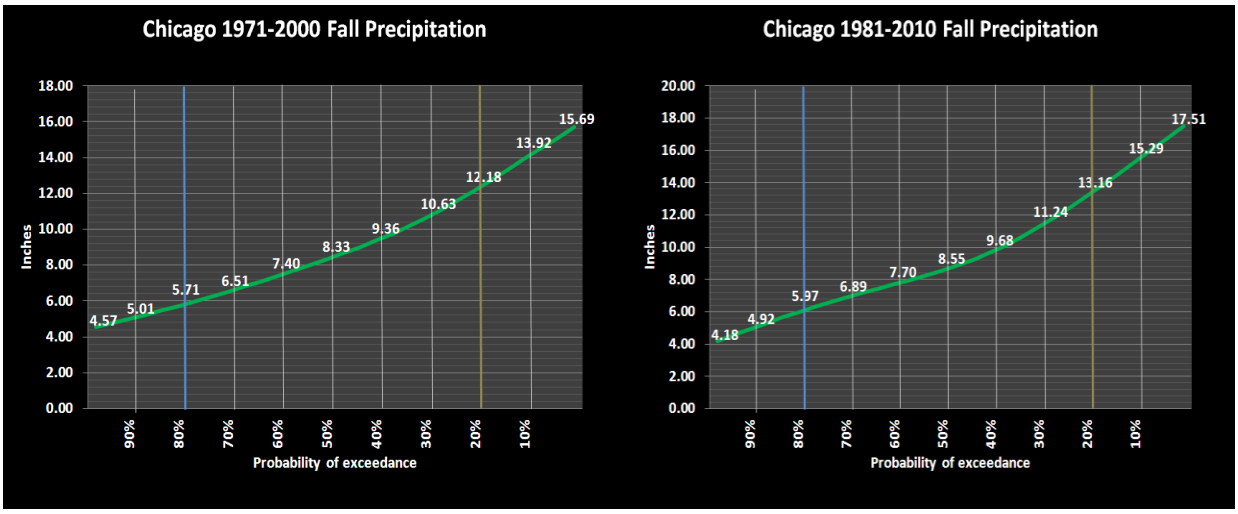

Chicago 1981-2010 Winter Precipitation
Inches
12.00
10.00
8.00
6.00
4.00
2.00
0.00
2.48
3.01
3.73
4.38
4.97
5.51
6.04
6.70
7.69
9.24
11.28
90.0%
80.0%
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
Probability of exceedance


Chicago 1971-2000 Spring Precipitation
Inches
20.00
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
3.87
4.78
6.13
7.48
8.80
9.98
10.98
11.96
13.22
15.08
17.51
90%
80%
70%
60%
50%
40%
30%
20%
10%
Probability of exceedance

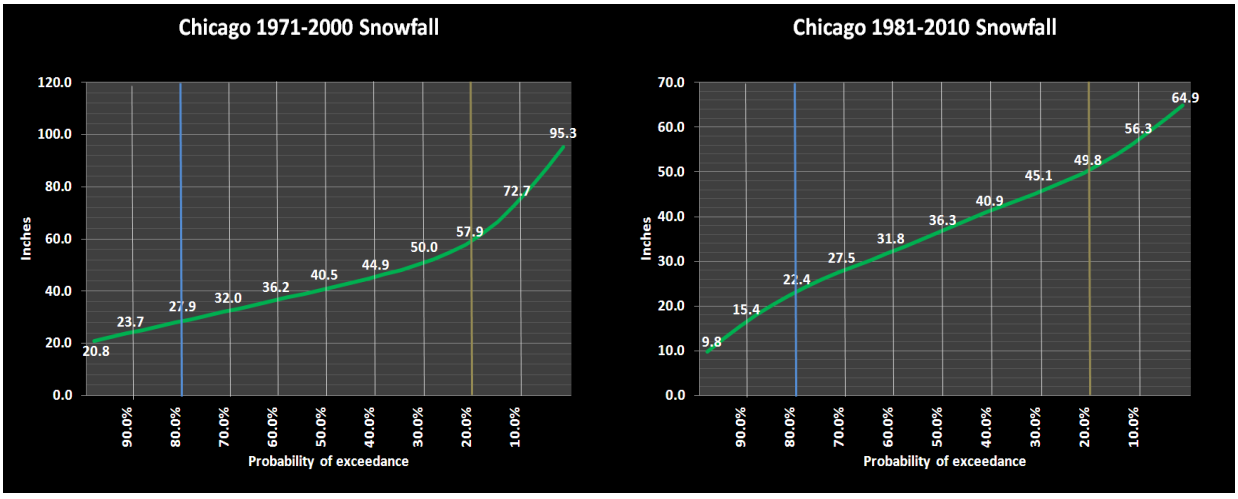

Chicago 1981-2010 Spring Precipitation
Inches
20.00
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
3.87
4.75
6.10
7.49
8.74
9.71
10.47
11.24
12.42
14.51
17.51
90%
80%
70%
60%
50%
40%
30%
20%
10%
Probability of exceedance


Chicago 1971-2000 Summer Precipitation
Inches
25.00
20.00
15.00
10.00
5.00
0.00
5.08
6.42
8.14
9.39
10.31
11.08
11.97
13.27
15.38
18.78
23.48
90%
80%
70%
60%
50%
40%
30%
20%
10%
Probability of exceedance


Chicago 1981-2010 Summer Precipitation
Inches
25.00
20.00
15.00
10.00
5.00
0.00
5.08
6.39
8.14
9.46
10.42
11.31
12.42
13.91
15.99
19.16
23.48
90%
80%
70%
60%
50%
40%
30%
20%
10%
Probability of exceedance



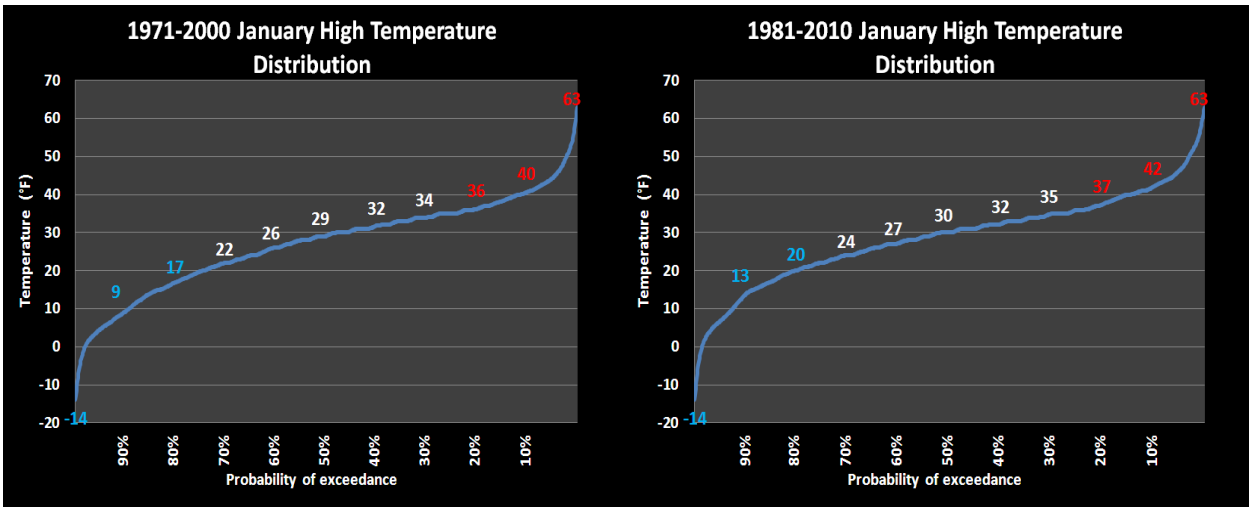
Annual snowfall also declined for the new 1981-2010 normals. The annual snowfall distributions are shown below from the old 1971-2000 period and the new 1981-2010 period. There are significant declines in snowfall amounts for all probabilities. For example the 50th percentile dropped from 40.5" to 36.3". This is likely a result of warmer winter season temperatures and a decline in the cold season precipitation mentioned above.

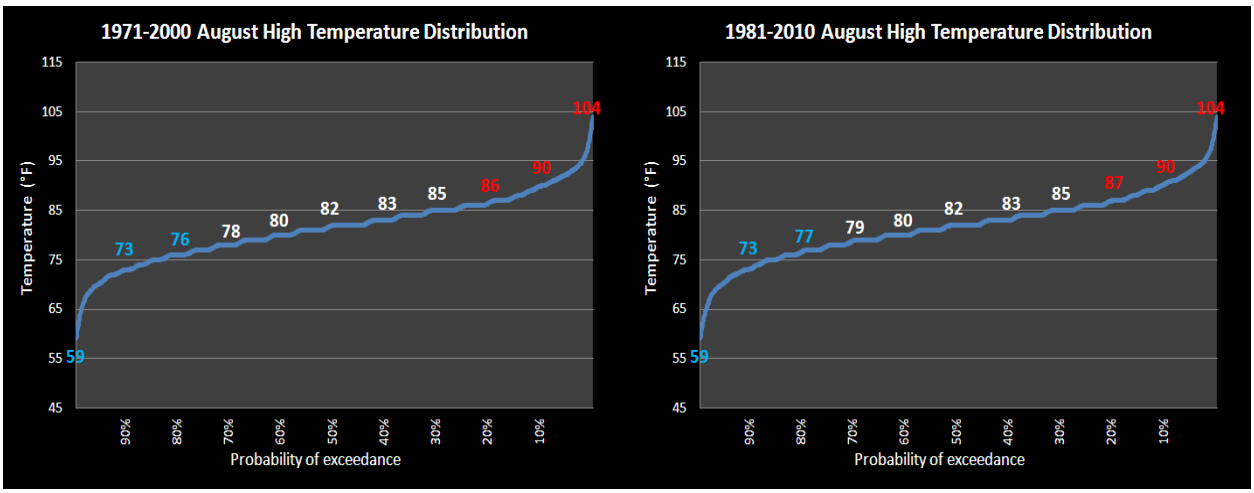


Rockford

To further illustrate the main changes in temperatures at Rockford from the old 1971-2000 climate normal period to the latest 1981-2010 climate normal period, figures displaying the probabilities of exceedance for both high and low temperatures were constructed. For simplicity,

the temperatures representing the 10th through the 90th percentiles have been added to the figures. Also displayed, are the highest and lowest temperatures recorded during the period. These graphics are the same as those used for Chicago. In order to interpret these graphics simply take, for example, the 80% percentile for high temperatures in January at Rockford. During the 1971-2000 period this corresponds to a temperature of 17 degrees. This means that on any given day during the month of January there was an 80% chance of experiencing a high temperature at or warmer than 17 degrees. Now comparing this to the 1981 to 2010 period, the 80 percentile has warmed to 20 degrees. This simply means that there is now a slightly higher than 80% chance of exceeding 17 degrees for a day time high temperature in January. The same technique can be used to interpret the remaining percentiles.





Although temperatures warmed for all percentiles in January, the most significant warming occurred with the higher probabilities (e.g. the colder temperatures). Similar to the results in Chicago, there was about a 2 to 3 degree increase in the 70th through the 90th percentiles. This means there were fewer very cold days during the 1981-2010 period relative to the 1971-2000

period. Table 4a. below shows that the number of days in January with high temperatures colder than 20 degrees dropped by 53. In contrast, the number of times in which the high temperatures exceeded 35 degrees increased by 28. This means that although the number of very cold temperatures decreased, there was not a correspondingly high increase in the number of very warm days.

This same behavior occurred to a much lesser extent during the summer season. The month of August is shown here, but other months during the warm season were similar. During August, there actually was not much of a change noted in the high temperature distributions shown above. However, table 4b. below shows that there was a slight increase in the number of very warm days and a nearly corresponding decrease in the number of cool days in the latest 30 year period.

Table 4a.

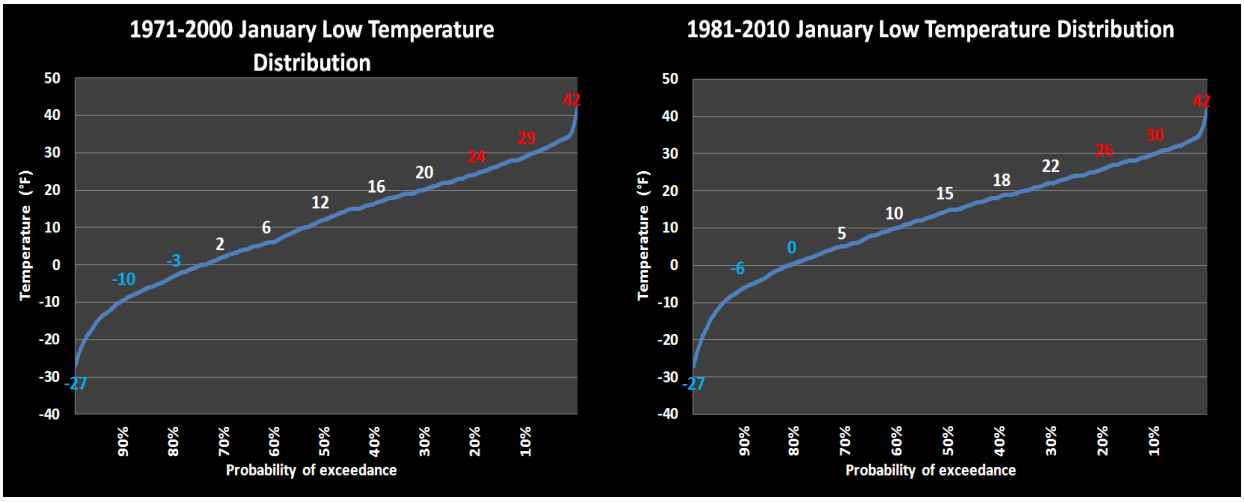
January	**Number of occurrences**							
High Temps	***70s***	***80s***	***90s***	***00s***		***81-10***	***71-00***	Difference
Above 40	26	41	29	54		124	96	+28
20-39	168	207	212	193		612	587	+25
Below 20	116	62	69	63		194	247	-53

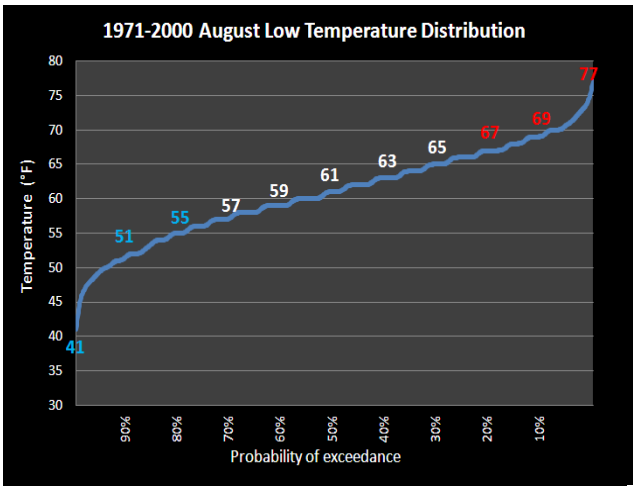
Table 4b.

August	**Number of occurrences**							
High Temps	***70s***	***80s***	***90s***	***00s***		***81-10***	***71-00***	Difference
Above 89	19	39	22	31		92	80	+12
75-89	239	223	226	243		692	688	+4
Below 75	52	48	62	36		146	162	-16

The behavior of daily low temperatures was similar to that observed with the daily high temperatures. However, the differences are a bit more robust during the cold season. The figures below indicate that there was at least a 2 degree increase throughout a majority of the distribution. Similar to daily high temperatures, the low temperatures showed the largest warming for the colder temperatures. A 3 to 4 degree increase in temperatures occurred from the 50^{th} through the 90^{th} percentiles. Based off this, it is not too surprising that the number of very cold low temperatures also decreased significantly (Table 5).

During August, little change was noted in low temperatures. However, similar to the daily high temperatures, there was a decrease noted in the number of cool low temperatures in the latest 30 year period (Table 5b.).





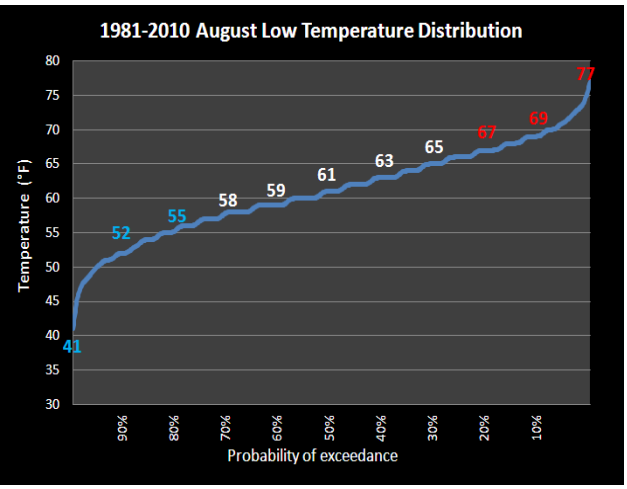


Table 5a.

January	Number of occurrences							
Low Temps	***70s***	***80s***	***90s***	***00s***		***81-10***	***71-00***	Difference
Below 1	116	67	65	50		182	248	-66
1 to 25	149	185	182	185		552	516	+36
Above 26	45	58	63	75		196	166	+30

Table 5b.

August	Number of occurrences							
Low Temps	70s	80s	90s	00s		81-10	71-00	Difference
Below 55	53	65	50	38		153	168	-15
55-70	230	207	240	246		693	677	+16
Above 70	27	38	20	26		84	85	-1

Precipitation

Average annual precipitation has decreased slightly from 36.63" to 36.24" for the new 30 year normal period at Rockford. However, this is not evenly spread throughout the year. The figures below display, the probability of exceedance for precipitation during all four meteorological seasons. Also shown are tables displaying the frequency of occurrences for various precipitation amounts for each season throughout the year. Overall, the figures indicate that precipitation decreased during the winter and spring seasons and increased during the summer and fall seasons. The tables below indicate that much of this decrease in precipitation during the winter and spring seasons was due to a sharp decrease in light (0.24" or less) events. In contrast, during the summer season, the increase in precipitation was largely due to increases in heavier rain events during the past decade.

Table 6a.

Winter	Number of occurrences							
Precipitation	70s	80s	90s	00s		81-10	71-00	Difference
0.01"-0.24"	266	256	252	221		729	774	-45
0.25"-0.49"	49	31	42	47		120	122	-2
0.50"-0.99"	22	18	23	18		59	63	-4
1.00"-1.49"	7	4	3	8		15	14	+1
1.5"+	2	1	1	1		3	4	-1

Table 6b.

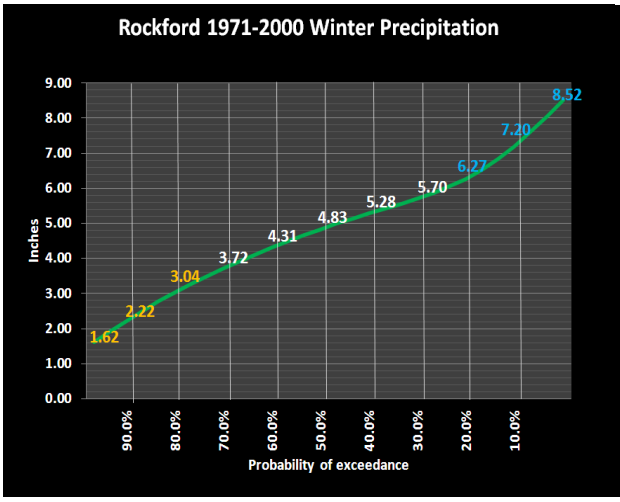
Spring	Number of occurrences							
Precipitation	70s	80s	90s	00s		81-10	71-00	Difference
0.01”-0.24”	293	266	282	262		810	841	-31
0.25”-0.49”	67	62	70	78		199	210	+11
0.50”-0.99”	52	41	47	37		125	140	-15
1.00”-1.49”	17	13	22	25		60	52	+8
1.5”-1.99”	4	5	7	2		14	16	-2
2.00”-2.49”	6	2	2	1		5	10	-5
2.50”+	2	0	0	0		0	2	-2

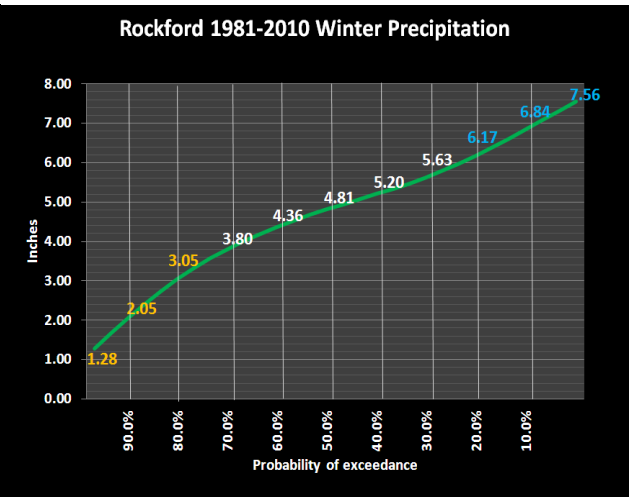
Table 6c.

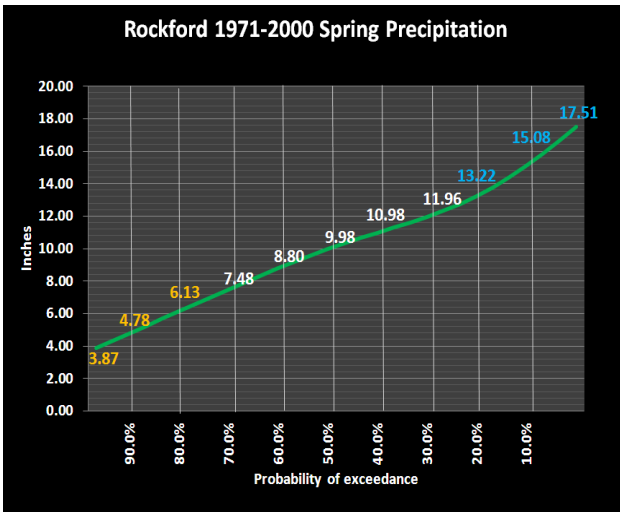
Summer	Number of occurrences							
Precipitation	70s	80s	90s	00s		81-10	71-00	Difference
0.01”-0.24”	223	210	245	238		693	678	+15
0.25”-0.49”	82	71	60	62		193	213	-20
0.50”-0.99”	59	68	68	63		199	195	+4
1.00”-1.49”	26	22	20	21		63	68	-5
1.5”-1.99”	11	11	17	12		40	39	+1
2.00”-2.49”	6	8	2	8		18	16	+2
2.50”-2.99”	5	4	5	6		15	14	+1
3.00”-3.49”	2	2	0	4		6	4	+2
3.50”+	2	1	2	4		7	5	+2

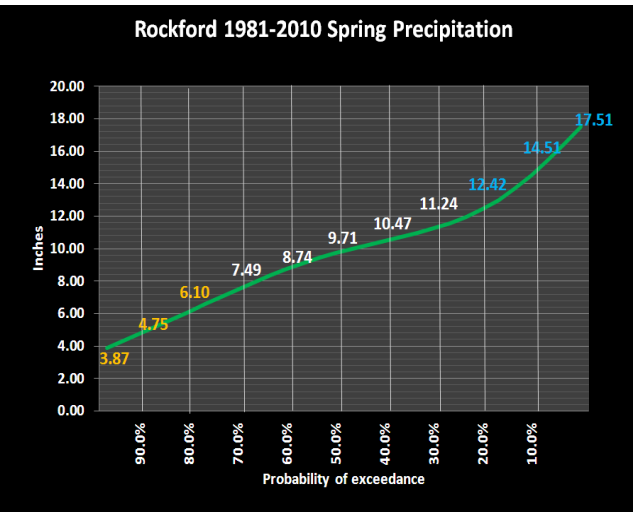
Table 6d.

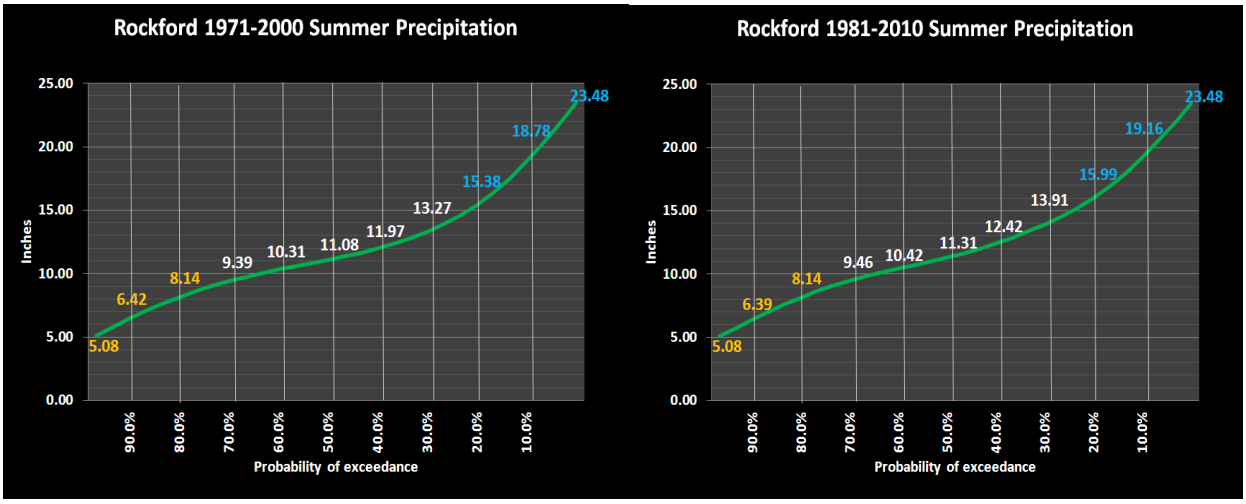
Fall	Number of occurrences							
Precipitation	70s	80s	90s	00s		81-10	71-00	Difference
0.01”-0.24”	224	253	211	199		663	688	-25
0.25”-0.49”	53	49	63	63		175	165	+10
0.50”-0.99”	35	62	38	38		138	135	+3
1.00”-1.49”	14	10	15	8		33	39	-6
1.5”-1.99”	5	8	6	5		19	19	0
2.00”-2.49”	3	2	6	3		11	11	0
2.50”-2.99”	2	0	1	0		1	3	-2
3.00”-3.49”	0	1	2	0		3	3	0
3.50”+	0	0	0	0		0	0	0

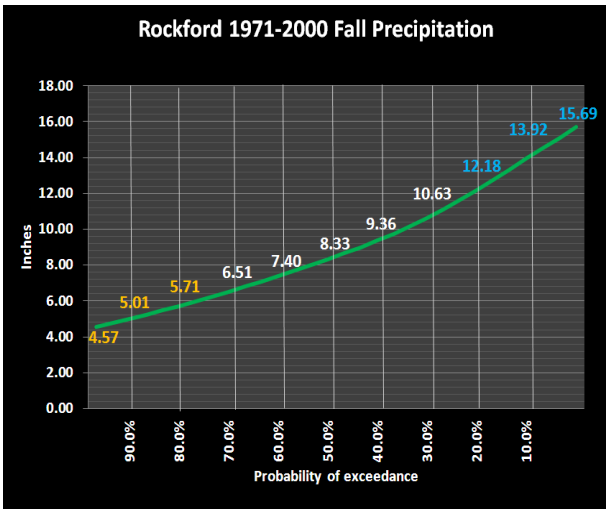

Rockford 1971-2000 Winter Precipitation
Inches
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
1.62
2.22
3.04
3.72
4.31
4.83
5.28
5.70
6.27
7.20
8.52
90.0%
80.0%
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
Probability of exceedance

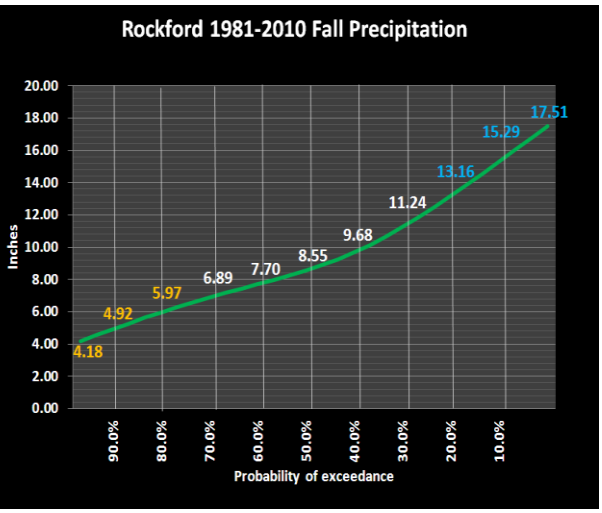

Rockford 1981-2010 Winter Precipitation
Inches
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
1.28
2.05
3.05
3.80
4.36
4.81
5.20
5.63
6.17
6.84
7.56
90.0%
80.0%
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
Probability of exceedance


Rockford 1971-2000 Spring Precipitation
Inches
20.00
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
3.87
4.78
6.13
7.48
8.80
9.98
10.98
11.96
13.22
15.08
17.51
90.0%
80.0%
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
Probability of exceedance

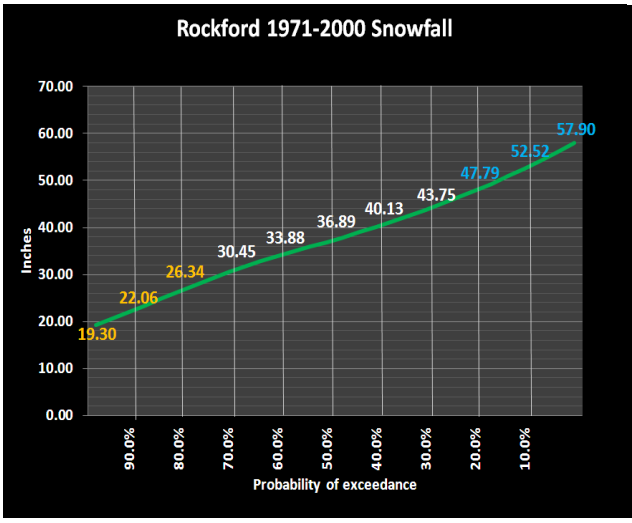

Rockford 1981-2010 Spring Precipitation
Inches
20.00
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
3.87
4.75
6.10
7.49
8.74
9.71
10.47
11.24
12.42
14.51
17.51
90.0%
80.0%
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
Probability of exceedance

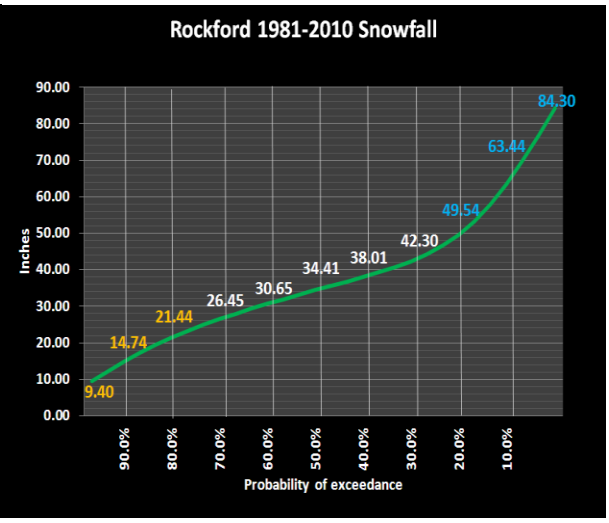






Annual snowfall also declined for the new 1981-2010 normals. The annual snowfall distributions are shown below from the old 1971-2000 and the new 1981-2010 periods. There are significant declines in snowfall amounts up to the 30 percentile. For example the 50th percentile dropped from 36.9" to 34.4". In spite of this, notice that the extreme amounts of snowfall (e.g., the 20 and the 10 percentiles) showed some significant increases. Thus it apparent from the figures that the new 30 year normal period has a larger spread from a low of 9.4" to a max of 80.3". Ironically, both of these extremes occurred within a few years of each other during the past decade. So overall, even though the average seasonal snowfall dropped slightly, there was definitely a tendency to see more extremely high and low amounts of snowfall especially during the past decade.


Rockford 1971-2000 Snowfall
Inches
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
19.30
22.06
26.34
30.45
33.88
36.89
40.13
43.75
47.79
52.52
57.90
90.0%
80.0%
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
Probability of exceedance


Rockford 1981-2010 Snowfall
Inches
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
9.40
14.74
21.44
26.45
30.65
34.41
38.01
42.30
49.54
63.44
84.30
90.0%
80.0%
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
Probability of exceedance